

CLAIMS

1. A method of direct filling without air bubbles and overlaying intertracks or zones (4) in hollows with respect to the surface of a substrate or of a printed circuit (1) by a viscous product 2, characterized in that it comprises:

- displacing the filling product (2) at the point of zones to be filled (4) by a means of displacing (3) in order to evacuate in the form of bubbles (6) the gas (5) present in the zones in hollows (4) and to substitute it by filling product (2)
- and adjusting the thickness of the product (2) at the surface of the substrate (1).

2. The method of filling according to claim 1, characterized in that it comprises successively:

- making the zone to be filled (4) impermeable to all entry of gas exterior to the zone (4), by spreading the product (2) at the surface of the substrate (1) in order to isolate the zones to be filled (4) from the exterior gas and to make the product (2) available.
- displacing the product (2) at the point of zones to be filled in order to evacuate, in the form of bubbles (6), the gas present in the zones to be filled (4) under the filling product (2),
- substituting the gas (5) evacuated in the form of bubbles (6), by the filling product (2),
- and adjusting the thickness of the product (2) at the surface of the substrate.

3. The method of filling according to claim 1, characterized in that the displacing of the product (2) at the point of the area to be filled (4) is obtained by a hydrodynamic effect.

4. The method of filling according to claim 1, characterized in that it comprises blocking the gas bubbles (6) extracted by the displacing means (3) of the filling product (2), with the scrapping means (9) so that they are not re-drawn in the zones to be filled (4).

5. The method of filling according to claim 1, characterized in that the aforementioned zones to be filled (4) are closed on the other face of the substrate (1) and have a long length.

6. The method of filling according to claim 1, characterized in that the speed of movement of the filling product (2) is adjustable.

7. The method of filling according to claim 1, characterized in that the displacing of the filling product (2) at the point of the zone to be filled (4) is obtained by a hydrodynamic effect of a roller in rotation (3) of which the axis is perpendicular to the movement of the substrate with respect to the device and parallel to the substrate and according to the direction such that the tangential movement of the roller at the point of the zone to be filled is opposed to the direction of displacement of the substrate (1).

8. The method of filling according to claim 1, characterized in that it associates a means for displacement (11) in translation of the substrate (1) to the action of a filling head (12) resting on the substrate (1) and containing the filling product (2), the aforementioned head (12) permitting the generation of a positive pressure differential between the downstream means for displacing (3) of the product (2) due to the concerted action of the aforementioned means for displacing (3) of the filling product (2) and a scraping element (7) forming in this manner a confined downstream zone of surge pressure totally occupied by the filling product and the means for displacing (3) causes a circulation of the filling product at the point of the zone to be filled in the direction opposed to the displacement of the substrate with respect to the filling head (12) forming in this manner an upstream zone of reduced pressure (D) in order to evacuate the gas (5) present in the zones to be filled (4) and to replace it by filling product (2) as the substrate (1) is displaced.

9. The method of filling according to claims 1, 7 and 8, characterized in that the roller (3) assuring the displacement of the filling product (2) is contained in the above-mentioned filling head (12).

10. The method of filling according to claims 8 and 9, characterized in that the speed of rotation and/or the diameter of the abovementioned roller (3) contained in the filling head (12) are adjustable in order to adjust the pressure differential of the confined zone of surge pressure (C) with respect to the zone of reduced pressure (D) permitting control of the running of the product (2) under the scrapping element (7) at the point of the zones to be filled (4) and to compensate for the trailing effect of the aforementioned scrapping element (7).

11. A filling device without mask or silk screen for zones located in hollows (4) with respect to the surface of the substrate (1) and closed on the other face of the substrate (1) and possibly of long length, with a liquid filling product more or less viscous (2), in translation relative to the surface of the substrate (1) and implementing the filling method according to any one of claims 1 to 11, characterized by the fact that it associates in the order according to the direction of relative displacement of the filling device with respect to the substrate (1) :

- a spreading element (10) for the filling product (2) at the surface of the substrate (1),
- a displacing element (3) for the filling product (2) at the point of the zone to be filled (4),
- an element (7) for adjusting the thickness or scraping the excess of the filling product (2), in a manner such that the above mentioned filling product (2) remains constantly in contact with the zone to be filled (4) from the beginning of the filling up to the scraping of the excess.

12. The filling device according to claim 11, characterized by the fact that displacing element (3) is constituted by a roller in rotation (3).

13. The filling device according to claim 11, characterized by the fact that the device is symmetric in order to be able to operate in the two directions and to be implemented on a silk screen machine.

14. The filling device according to claim 11, characterized by the fact that the aforementioned relative movement in translation of the filling product (2) relative to the surface of the substrate (1) is obtained by maintaining the filling device for the product (2) fixed while the substrate (1) is moving.

15. The filling device according to claims 11 and 12, characterized by the fact that it comprises a scraper (9) for blocking the bubbles (6) extracted by the abovementioned displacing element (3).

16. The filling device according to any one of the claims 11 to 15, characterized by the fact that it is composed :

- of a filling head (12) comprising :

a) a chamber (13) containing the filling product (2), the aforementioned chamber (13) being delimited downstream by a scraper (7) inclined at an angle α less than or equal to 90° and upstream by a scraper (10) inclined in the same direction at an angle β equal to or greater than 90°

b) a roller (3) placed between the scrapers (7) and (10) for displacing of the product (2) and turning in the direction such that the tangential movement of the roller (3) at the point of the zones to be filled is opposed to the movement in translation (arrow A) of the substrate with respect to the filling device.

- and a means for displacement in translation (11) of the substrate (1), permitting a continuous running (arrow A) of it under the above-mentioned filling head (12).

17. The filling device according to claim 11, characterized by the fact that the above-mentioned means for displacing in translation (11) of the substrate (1) is a conveyor belt.

18. The filling device according to claim (16), characterized by the fact that the above mentioned filling head (12) is equipped with a sealing element arranged in its lower part.

19. The filling device according to claim 16, characterized by the fact that the above mentioned filling head (12) is adjustable in length according to the width of the substrate (1) to be treated.

20. The filling device according to claim 16, characterized by the fact that the above mentioned filling head (12) is adapted to the width of the substrate (1) to be treated and that a system of rapid fixation permits switching from one filling head to another.

21. The filling device according to claim 16, characterized by the fact that the above mentioned roller (3) comprises fins parallel to the axis of the roller in order to accentuate the displacement of the filling product (2).

22. The filling device according to claims 15 and 16, characterized by the fact that the above-mentioned scraper (9) is tangentially placed on the upper part of the displacing element (3) in a manner to cause the evacuation of the air bubbles (6).

23. The filling device according to any one of claims 12 to 22, characterized by the fact that the above-mentioned substrate (1) is a printed circuit.

24. The filling device according to any one of claims 12 to 23, characterized by the fact that the above-mentioned filling head (12) containing the filling product (2) is closed.

25. The filling device according to any one of claims 12 to 23, characterized by the fact that the above mentioned filling head (12) containing the filling product (2) is closed with creation of a level of vacuum in its part situated above the filling

product (2) to promote the evacuation of the extracted air from the zones to be filled (4) of the substrate (1).

26. An apparatus associated with a filling device according to any of claims 12 to 25, characterized by the fact that it is composed :

- of the conveyor (11), that assures the translation A of the substrates 1 below the filling head (12),
- of a feeding conveyor (20) situated upstream from the conveyor (11) to transport the substrates to be filled (1) to the conveyor (11) below the filling head (12),
- and of an evacuation conveyor (30) situated downstream from the conveyor (11) for recuperating the substrates (1) that have just been filled by the filling head (12).

27. The apparatus according to claim 26, characterized by the fact that the conveyor (11) is constituted by an endless belt (110) and that engaged around two cylinders (111 and 112), at least one of which is driving, is associated at the entrance to pressing cylinders (120a and 120b) arranged above the belt (110) in order to maintain under pressure and to drive the substrates (1) that have just exited the admission conveyor (20) onto the belt (110) below the filling head (12).

28. The apparatus according to claim 26, characterized by the fact that the feeding conveyor (20) is the roller type and comprises a centering device (21) formed from two guiding rails (21a and 21b) bordered on the interior by rolling rollers and that, mounted adjustable in width, permit to appropriately position the substrates (1) before their admission under the filling head (12) on the conveyor (11).

29. The apparatus according to claim 26, characterized by the fact that it comprises a continuous cleaning device (22) for the endless belt (110) that, constituted by at least a blade (22a or 22b) is arranged to push onto the external surface of the belt (110) under the conveyor (11) to form scrapers.

30. The apparatus according to claim 26, characterized by the fact that the evacuation conveyor (30) is of the belt type and permits transportation of the substrates (1) that have just been filled by the head (12) to another treatment unit.